NOAA FISHERIES

NW Fisheries Science Center

Opportunities for improvement at NWFSC

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Question

Are there areas of expertise that could be added in the future to strengthen the ability of the Center to meet its management and research objectives?

Better understanding of fish biology and oceanography

- Spawning location
  - Still unknown for many species!
- Movement and migration
  - Necessary to interpret stock structure
  - Can be estimated from tag-resighting data
  - Also, genetics can inform movement on multi-generation time scales
- Natural mortality rates
  - Can sometimes be estimated internally (given correct model!)
- Variation in growth and maturity rates
  - Important on California Current (Black et al. MEPS 2009)

Ecosystem implications

- Need people to expand ecosystem focus for assessment
  - Multi-species models
  - Juvenile surveys
  - Variation in maturity, growth, etc.
- Improved collection and analysis of stomach content data
  - Useful for inferring predation and ration
  - Could perhaps inform reconstructions of predation mortality
  - Fishery management targets are highly sensitive to changes in natural mortality

Bioeconomic models and management strategies

- **MSEs are very time-intensive**
  - Often takes more time than a full benchmark assessment!
- **However, they are the gold standard for:**
  1. Deciding on appropriate model complexity
  2. Interpreting appropriate precaution in setting OFLs given ABCs
  3. Assessing probability of initiating a costly rebuilding plan
  4. Evaluating proposed change in data collection protocol
- **Bioeconomic models are also useful**
  1. Priors on fishing mortality for data-limited species
  2. Understanding shifts in selectivity given spatial management

Improvements and standardization of software and computation

- Software is increasingly standardized for assessments
  - Operational approach to assessment (Methot 2009 book chapter)
  - Decreases risk of programming error (Maunder et al. 2009 book chapter)
- Software can be distributed and shared
  - R-forge for delta-GLMM, ageing error, nonlinear forecasting, survey plotting, R4SS, etc.
  - Allows reversion for coding errors, repositing for previo

Spatial analysis and models

- **Spatial models may improve index standardization**
  - Decrease imprecision for patchy or data-poor species (Shelton et al. In review)
- **Improved assessment of habitat requirements**
  - Estimate spatial variation in growth as function of static/dynamic habitat
- **Spatial approach to assessments**
  - Spatial delay-difference model as data-moderate tool (Thorson et al. In prep.)
- **Space is necessary to interpret historical data**
  - Combining AFSC and NWFSC trawl surveys (also requires seasonal analysis)
  - Interpreting historical maturity, growth, and diet samples

Question

Are there important topics for future research that have not been covered elsewhere?

Data-limited improvements

- **Explore incorporation of compositional data for recent surveys**
  - Estimate fishing mortality to replace depletion prior
- **Improve estimates of depletion prior**
  - Using productivity-susceptibility analysis
  - Incorporate prior information on fishing mortality for multispecies fisheries
- **Develop faster methods for estimating data-moderate methods**
  - Faster responses to Borel's Paradox
  - Improved convergence diagnostics for Adaptive Importance Sampling
- **Analytical improvements**
  - State-space estimation (i.e. recruitment variability)
  - Flexible production functions
- **Develop next-generation tools**
  - Spatial analysis tools may be more efficient use of available data
  - Multispecies tools ("Robin-Hood Approach") might pool limited information

Category 1 improvements

- **Improved options and best-practices for selectivity**
  - Account for spatial management changes
- **Improvements in growth modelling and processing**
  - When to use empirical size-at-age vs. explicit estimation
  - How to pre-process empirical size at age
- **Best practices for time-varying effects**
  - Model selection diagnostics for Laplace Approximation
- **Develop next-generation tools**
  - Stratified or continuous-space models?
  - Analysis of survey data internally to model
  - Inclusion of diet and/or M2 components

Data processing improvements

- **Improved ageing error tools**
  - Penalize variability in true proportion at age
- **Improve compositional standardization tools**
  - Generalized and publically available software for comp expansion and analysis
  - Application to target and mixed-species fisheries
- **Improve other tools for pre-processing data inputs**
  - Discard estimation
  - Total catch estimation, including imprecision estimates
  - Maturity schedule, including annual variation
  - Fishery catch-per-unit-effort standardization tools that can pass review

Question

Should the Center be taking greater advantage of opportunities for collaboration in conducting fishery stock assessments and related research, including shared approaches with other Centers, regional academic partners, other government agency partners, and stakeholders?

Collaborations with other centers:

1. **Forecasting recruitment improvements**
   - SAIP funded – 1 assessor from each center
2. **R4SS**
   - Used throughout US and internationally
   - Standardizes reporting, diagnostics, and model evaluation
3. **NWFSC SVN**
   - Shared delta-GLMM with AFSC
   - Ageing error software used by SEFSC, AFSC, and halibut commission
4. **Productivity Susceptibility Analaysis**
   - Central office with W. Patrick
   - Evaluating FishBase with W. Patrick

Collaborations with regional academic partners

- **Close relationship with UW**
  - Sea Grant fellowships (Monnahan – MCMC; Thorson – survey analysis; Haltuch – climate; Stewart – data-weighting)
  - FATE funding (Lee – growth; Stachura – growth)
  - HAIP funding (Ono – survey analysis)
  - SAIP funding (Martin – recruitment forecasting)
  - Think Tanks (15 meetings per year for 10+ years)
- **Working with OSU**
  - Per recruit methods (Stephens in prep)
  - Data-limited and Pop. Dy. (Cope and Heppell)
- **Other schools too**
  - University of Bergen
  - UC Santa Diego (i.e., B. Semmens)

Collaborations with other agencies

- **USGS**
  - Powell center – working group on count-data models (3-4 pubs)
- **Pacific States Marine Fisheries Commission**
  - Observer data collection and analysis
- **CAPAM**
  - Selectivity, growth meetings
- **IATTC**
- **Halibut Commission**
  - Data weighting issues
- **State Agencies**
  - Catch reconstruction
  - Sample collection

Collaborations with stakeholders

- **Facilitated by Council Process**
  - Groundfish Management Team
- **Pacific hake**
  - Developed MSE for evaluating performance with industry input
- **ENGOs**
  - TNC and hotspots
  - Environmental Defense and data-poor methods
- **Fishery**
  - Data-collection in trawl shelf/slope survey
  - Hook and line survey